
# DIY

***Worthwhile projects you can build on your own***

## Random-wire antenna

There might come a time when you'll find yourself with an HF transceiver, but in need of an antenna that's not readily available. In the early days of amateur radio, many operators discovered that they could easily build or acquire an AM transmitter and receiver, but could not afford a shiny, new beam. Instead, they often resorted to using an unknown length of wire left over from another project or from somebody's junk pile, and created a *random-wire antenna*.

A random-wire antenna is nothing more than an a wire of arbitrary length, but that's long enough to serve your HF needs. And because it connects to your station by one end (rather than somewhere in the middle) of the antenna, it's considered an *end-fed antenna*, complete with all the advantages (multiple bands) and disadvantages (shack RF generator and high impedance) that go with an end-fed type. But because its length is rather undetermined, it's not likely to be resonant on any amateur frequency.

In fact, if you have a choice, you should obtain the reasonably longest wire you can find. And if you intend to use it only for receiving, such as for both amateur and shortwave bands, the wire is pretty much all you'll need. But if you plan to also transmit on amateur bands using the wire, you'll need to use a wide-range (matches high SWR) ***antenna tuner***.

Many modern transceivers include a built-in tuner, but many internal ones will not match a random-length wire antenna sufficiently to bring its SWR into tunable range, usually making an external tuner necessary. If your engineering skills are adequate, you can create a *matching network* instead, but today's commercial or store-bought tuners tend to cover a greater bandwidth, making a purchase rather attractive for most of us mere mortals.

Let's see what it'll take to get a random-wire antenna up and running.

### Parts list

~500 feet 14 AWG THHN stranded wire

Two dogbone insulators

One ½˝ ground rod

One 1 ft RG-8X coax PL-259

Heat shrink tubing

One LDG AT-100ProII auto-tuner

100 feet of paracord

One ground clamp

1 pkg crimp sleeves and a crimper

### Construction

As mentioned, you should start with as long a wire as you can reasonably handle. You should also set aside an insulated counterpoise wire that's a quarter-wavelength of the lowest frequency you intend to use. A counterpoise is necessary for a random-wire antenna's performance, and to (help, but not completely) reduce the effects of common-mode current in your ham shack. For example, an 80-meter station should use a counterpoise wire that is

234 ÷ 3.6 MHz = 65 feet long.

The value "234" is the conversion factor between a quarter-wavelength in MHz and feet, including the velocity factor of copper.


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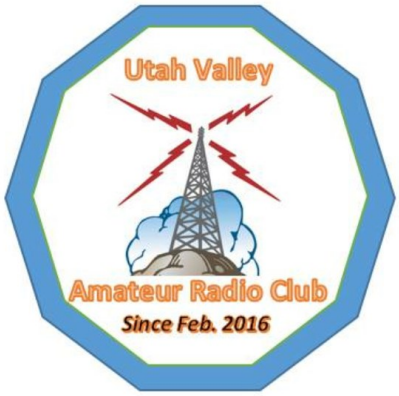
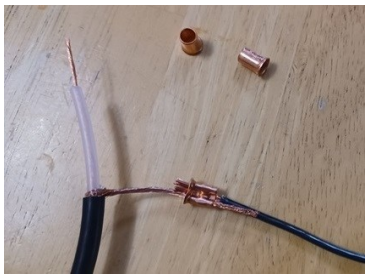
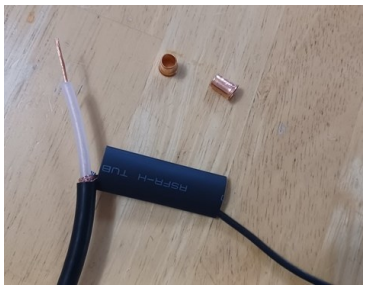
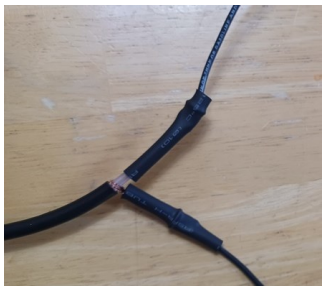
## *Random-wire antenna*




Cut the 1-foot coax in half and separate two inches of center conductor from the braid. Slip heat shrink tubing onto the counterpoise wire, crimp the counterpoise wire to the coax braid, and heat the tubing to insulate it from nearby conductors. Put a piece of masking tape around the counterpoise wire to differentiate it from the antenna wire.




Slip one end of the antenna wire through a dogbone insulator, then strip the same end of the antenna wire. Slip heat shrink tubing onto the antenna wire, crimp the antenna wire to the coax center conductor, slip the tubing over the crimped junction, and heat the tubing.

Insert the far end of the wire into a crimp sleeve, through one hole of a dogbone insulator, back through the same sleeve, and crimp the sleeve. Insert paracord through the other hole to tie the far end of the wire to a tree, fence, or other stable mounting point. Mount the antenna wire as high up as you can reasonably get it, the higher the better. If you don't have strong, independent supports, try draping the antenna wire over trees or anything else that'll get it high off the ground, again making sure the wire doesn't come near anything conductive.


Slip another piece of paracord through the empty hole of the dogbone insulator at the near end to tie it to something near your shack entry point. Leave enough slack in the antenna wire


# DIY, continued

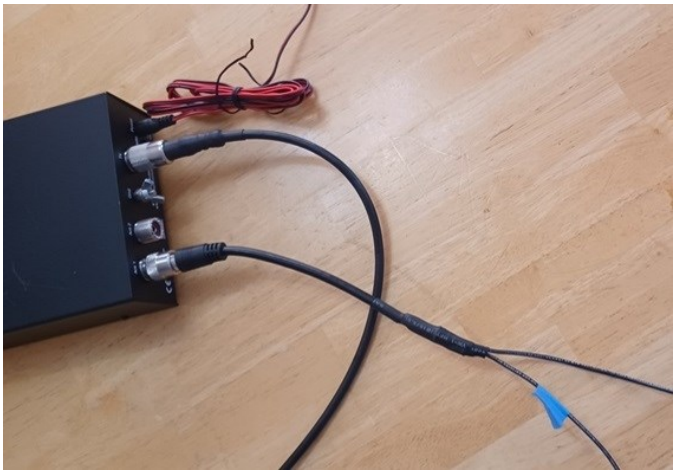
## *Random-wire antenna*

to reach your tuner. Pinch the antenna wire around itself just outside the near-end dogbone insulator, and wrap one or two zip ties around it (just the wires) to form a strain relief. With the zip ties, form a loop large enough to allow free movement of the wires through it, but slightly smaller than the diameter of the dogbone insulator.

### Installation and routing

Perhaps the most difficult task of installing a random-wire antenna is the routing of the antenna and counterpoise wires into your shack from the outside. We've covered some possibilities of doing just that with coax in a previous article, but we're dealing with a pair of plain, insulated wires in this case, which can be a little easier in a way, but come with some constraints because they're not shielded like coax is.

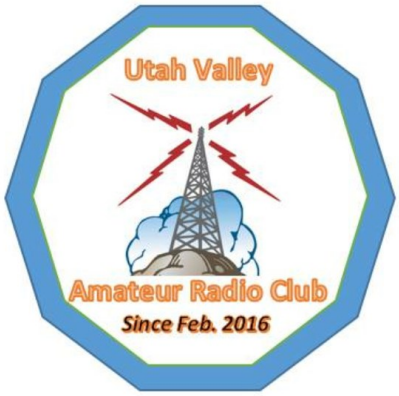
As much as possible, be sure to keep the antenna wire away from anything electrically conductive, such as gutters, aluminum siding, metal sheds, topsoil, metal window frames, and chain-linked fence. The wire will easily couple with metallic objects that are within a few inches of it, at the intended operating frequencies.



Lay the counterpoise wire on the ground and out from your shack. Drive all but six inches of the ground rod into the dirt a couple of feet closer to your shack than the end of the counterpoise wire. Attach the counterpoise wire to the ground rod using a ground clamp. Plug the PL-259 end of the 6-inch coax into the tuner "Antenna" connector. I selected the LDG AT-100Pro II tuner because of its wide tuning range (6 to 1000 ohms, or 20:1 SWR) for the price, but there are others that perform just as well for a reasonable price.

### Long-wire antenna

By the way, some confuse the *long-wire antenna* with the random-wire antenna, and mistakenly use the terms interchangeably. While the difference between them might seem like semantics, a long-wire antenna is generally understood as one with a specified or pre-determined length, often a half-wavelength or quarter-wavelength multiple of the target band, while the


# DIY, continued

## *Random-wire antenna*

length of a random-wire antenna is generally regarded as unknown or unrelated to any multiple of known operating frequencies.

With all due respect to our truly "random" wire in this discussion, it turns out that some lengths of wire work better than others, in that they might be easier to tune. If you have the ability to actually measure the length of your antenna wire, the following long-wire antenna values (in feet) seem to work well for random-wire antennas, according to Jack Clarke VE3EED:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 35.5 | 41 | 58 | 71 | 84 | 107 | 119 | 148 | 203 | 347 | 407 | 423 |

### Advantages and disadvantages

One drawback of the random-wire antenna you might encounter is the presence of *shack RF*, due to the fact that part of the antenna is inside your shack up to the tuner. While transmitting, this can cause your mic and rig enclosure to become too electrically active to touch ("hot"), your Wi-Fi router to lose internet connection, or a buzz to be transmitted with your signal. The ground connection on the tuner (directly connected in our case to the counterpoise wire) will help with some of this, but not all. You might need to install a common-mode choke between the tuner and the antenna to effectively reduce the amount of *noticeable* shack RF.

The good news is that we didn't need to make or buy a center insulator, purchase a feed line, or pull out the calculator to arrive at some engineering quantities. You might have wondered what kind of HF antenna you can install during an emergency, when you have nothing but wire. Even if you don't have one pre-made, like the one described in this discussion, you now have the knowledge to get something up. All you need is a rig, a good tuner, and some long, random-length wire. You can read an ARRL article on random-wire antennas here.

### Summary

A random-wire antenna is nothing more than a length of wire used in an end-fed configuration, but it needs to be long enough to form an acceptable radiating element for HF frequencies. While simple in concept, actually constructing and installing one can get a little involved. It's not the same as a long-wire antenna, which is a wire antenna whose length is cut in relation to an actual fraction of a target frequency.

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